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(54) Fastener System

**(72) Schuring, Eric J. , Canada
Girimonte, Vincent , Canada**

(73) ITW Plastiglide , Canada

(57) 8 Claims



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FASTENER SYSTEM

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ABSTRACT

Disclosed is a fastener system comprising a male or stud element with a split or bifurcated head, forming two prongs, that fit inside a female or socket sleeve. Inside the socket sleeve is an internal annular ring of lesser diameter. The stud prongs deflect when pushed in contact with the internal ring until the prongs pass the ring at which point they deflect out and lock into the sleeve. This locking action allows for a variety of items to be clamped together along the length of the rivet sleeve providing that at each end there is a head of larger diameter than the sleeve. This head can be replaced by any number of integrally molded items requiring a locking/mating action or where locking and rotation is desired.

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FASTENER SYSTEM

Field of the Invention

The invention pertains to fastener systems and more particularly to a snap action fastener system between male and female parts. The parts can be used in the manner of a rivet, but are not limited thereto and the fastener system may be used to axially secure a roller device to a support member.

Background of the Invention

Rivets and the like are well known fastener elements and often in the past they were constructed of metal. More recently, rivets have been made of plastic materials and Canadian patent 908,396 to Seckerson is typical of a rivet fastener system using a stud and socket concept (male and female parts). However, previous fasteners often suffer from not being particularly strong in shear and providing undesirable side-to-side movement.

Further, two part fastener systems often depend on the end of the socket contacting the head of the stud to limit insertion even though withdrawal of the stud is prevented by cooperating internal confronting shoulders.

Further, in one prior art device, the stud shank has a solid shouldered end with the socket or female portion having a trifurcated annular collar. The furcations permit flexing of the collar in order to allow the end of the shank to pass through the collar opening and snap into place behind the collar.

Notwithstanding this prior art, there is still a need for a fastener device which is adapted to provide not only a rivet system but can also provide a fastener system wherein one of the studs and socket is designed for some other use than as a rivet head such as a roller. The other of the two parts may act



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as a support member for closet doors or the like. In such cases good shear strength is provided along with good rotational contact. Nevertheless little side-to-side movement and substantially no axially movement is allowed with this fastener system.

Summary of the Invention

Briefly the invention consists of a male or stud element with a split or bifurcated head, forming two prongs, that fit inside a female or socket sleeve. Inside the socket sleeve is an internal annular ring of lesser diameter. The stud prongs deflect when pushed in contact with the internal ring until the prongs pass the ring at which point they deflect out and lock into the sleeve. This locking action allows for a variety of items to be clamped together along the length of the rivet sleeve providing that at each end there is a head of larger diameter than the sleeve. This head can be replaced by any number of integrally molded items requiring a locking/mating action or where locking and rotation is desired.

This fastener system in many instances can replace metal rivets, is non-corrosive, allows for rotational motion, and is strong in shear force. The length of the clamping area can be varied to suit the application. There is minimal side-to-side movement of the stud inside the socket thus improving shear and torsional strength over the prior art. There is also no axial movement when the members are secured together. As a rivet, the fastening system finds application in securing shell, foam and inner material together in sports equipment, particularly hockey shin pads, shoulder and elbow pads. As a system wherein rotation is particularly involved, the device may be adapted to secure the shaft of a roller for a closet door track system.

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Accordingly the invention pertains to a two part fastener system, comprising a male member and a female member, the male member including a shank having an end and having serially along its axis toward the end a first generally cylindrical portion, a first generally frustoconical portion, a second generally cylindrical portion of less diametrical extent than that of the first cylindrical portion and a third generally cylindrical portion having a diameter which is substantially equal to that of the first cylindrical portion and defining a 10 radial shoulder, extending substantially perpendicular with respect to the axis of the shank, along with the second cylindrical portion. There is also a second generally frustoconical portion and a groove extending axially inwardly from the shank end so as to bifurcate at least the first and second frustoconical portions and the third and second cylindrical portions. The female member includes a bore having a series of internal surfaces including a frustoconical surface for biasing the bifurcated shank end radially inwardly and a surface defining a radial shoulder, extending substantially perpendicular 20 with respect to a longitudinal axis of the bore of the female member, for operative cooperation with the shank shoulder. The axial and radial dimensions of the second cylindrical shank

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portion and the first frustoconical shank portion of the male member relative to the dimensions of the frustoconical and shoulder surfaces of the female bore are such that when the male and female members are axially assembled together, a locking snap action connection between the male and female members is achieved wherein the operative cooperating radial, axial and frustoconical surfaces permit only rotary movement of the male and female members relative to each other while substantial axial movement of the male and female members with respect to each other is effectively prevented.

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A suitable plastic material for the fastener system is nylon. Nylon 6 or 66 are particularly preferred. However, in the embodiment including a roller member, the member may be of an acetal plastic material.

Brief Description of the Drawings

FIGURE 1 is a side sectional view of the two part fastening system in association with a rivet.

FIGURES 2, 3 and 4 are sectional views taken along lines 2 - 2, 3 - 3 and 4 - 4 of FIGURE 1.

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FIGURE 5 is a modification of the rivet of FIGURE 1.

FIGURE 6 is a sectional view taken along the lines 6 - 6 of FIGURE 5.

FIGURE 7 is a perspective view of another use to which the fastening system is adapted.

FIGURE 8 is a sectional view taken along the lines 8 - 8 of FIGURE 7.

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Description of the Preferred Embodiments

Figures 1 - 4 show, in cross-section, one embodiment of the invention of the fastener system. In particular, rivet 10, includes stud or male part 12 having circular flanged head 14 having a flat inner surface 16 and slightly convex outer surface 18 merging into peripheral edge 20.

Shank 22 has a cruciform cross-sectional configuration adjacent flanged head 12 (Figure 2) formed by recess 24. As seen in Figure 2, the cruciform configuration provides arcuate shank portions 26. As will be seen in Figure 1, shank 22 and in particular portions 26 are slightly tapered from head inner surface 16 to transition line 32, the taper being preferably about 3° to shank axis 34. The recesses 24 stop short of transition line 32 where the shank cross-section is generally circular. Shank 26 then slopes inwardly at about 30° to shank axis 34 defining conical surface 36 and extends axially to define cylindrical surface 38.

Bifurcated prong or end 40 comprises two identically molded parts 42 divided by groove 44 having a flat end 46, a chamfered or sloped side 48 and a cylindrical section 50, sloped side 48, being at about 30° to shank axis 34. Each part 42 of end 40 has a shoulder 52 which inwardly meets cylindrical shank portion 38.

It will be seen from Figure 4 that end parts 42 are flattened at 60 on each side. Groove 44 extends into the shank 26 past shoulders 52 and terminates at curved point 54 just short of transition line 32. Groove 44 has an included angle of 10°, 5° on each shank of axis 34.

Female or socket part 70 of rivet 10 has outer flange

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end 72 with outer surface 74, slightly tapering toward inner flat surface 76, and peripheral edge 78.

Female part 70 has an inner cylindrical bore 80 terminating at shoulder 82. Inner cylindrical bore 86 and conical or tapered portion 88 and 90 are generally complementary to the portions 38, 36 and 26 of shank 22. Female part 70 has outer cylindrical surface 92 with inner curved end 94 meeting slightly tapered bore 90.

10 The connection of male part 10 and female part 80 will be evident from the above description and Figures 1 - 4. As male prong 40 is inserted into female bore 90, there is no flexing of parts 42 since the diameter of cylindrical portion 50 of ends 42 is approximately that of shank transitional area 32. Once inserted, slope surfaces 48 of ends 42 will contact sloped surface 36 and be flexed inwardly through bore 86 until cylindrical portion 50 of ends 42 passes through bore 84 whereupon male part shoulders 52 will snap into confronting association with female part shoulders 82.

20 The complementarily tapered surfaces 36 and 88 of the male and female portions respectively limit inward movement of the male member 10. Female end 94 is spaced from male inner surface 16. Further, the recesses 24 provide for a reduction in weight of the rivet and reduces rotational friction as may be important in the various uses of the snap action device.

Figures 5 and 6 show a variation in the fastener system as a rivet wherein like numbers with a prime ('') correspond to like parts or features in Figures 1 - 4. However, it will be noted that the shank is longer and the male part 12' includes a portion 100 adjacent head 14 and there are additional recesses

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104 of recesses 24' extending into portion 100. Sides 106 of portions 100 are flat. Although bore 90' is slightly tapered, shank portions 26' are not in this embodiment.

Figures 7 and 8 show the use of the fastener system for securing a roller 110 to a closet door hanger 112, the specific details of which hanger other than the fastening system are not significant to the invention herein. As will be apparent from Figure 8, the roller 100 has shank 126 with a bifurcated prong on end 140 which shank and prong are constructed in accordance with the details of Figures 1 - 6. However, the shank 126 is solid without recesses. It will be noted that the tapered configuration of the shank and bore about the transition area 134, along with the cooperation of the shoulders 152 and 182 provide a tight, snap action connection. The connection allows for the necessary rotation of roller 110 as well as providing a secure locking action. The connection is strong in shear and therefore capable of providing a strong yet economical roller mechanism.

Although we have provided a simple but effective fastener system capable of being used not only in the riveting art where a strong locking mating action is required but also a strong locking rotation action when desired, the system described are preferred embodiments and obvious modifications will be apparent to those skilled in the art and we claim such modifications that fall within the claims of this application.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A two part fastener system, comprising:

a male member; and
a female member;

said male member including a shank having an end and having serially along its axis toward said end a first generally cylindrical portion; a first generally frustoconical portion; a second generally cylindrical portion of less diametrical extent than that of said first cylindrical portion; a third generally cylindrical portion having a diameter which is substantially equal to that of said first cylindrical portion and defining a radial shoulder, extending substantially perpendicular with respect to said axis of said shank, along with said second cylindrical portion and a second generally frustoconical portion; a groove also extending axially inwardly from said shank end so as to bifurcate at least said first and second frustoconical portions and said third and second cylindrical portions;

said female member including a bore having a series of internal surfaces including a frustoconical surface for biasing said bifurcated shank end radially inwardly and a surface defining a radial shoulder, extending substantially perpendicular with respect to a longitudinal axis of said bore of said female member, for operative cooperation with said shank shoulder,

the axial and radial dimensions of said second cylindrical shank portion and said first frustoconical shank portion of said male member relative to the dimensions of said frustoconical and shoulder surfaces of said female bore being

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such that when said male and female members are axially assembled together, a locking snap action connection between said male and female members is achieved wherein said operative cooperating radial, axial and frustoconical surfaces permit only rotary movement of said male and female members relative to each other while substantial axial movement of said male and female members with respect to each other is effectively prevented.

2. The invention of claim 1 wherein the shank first cylindrical portion has a cruciform cross-sectional configuration for a substantial portion of its axial extent.

3. The invention of claim 1 wherein said first generally cylindrical portion is tapered inwardly slightly and said female member has a complementary shaped bore surface.

4. The invention of claim 1, 2 or 3 wherein the two part fastening system is a rivet, each member having an integral head element.

5. The invention of claim 1, ² ~~3~~ or 3 wherein the two part fastening system is associated with securing roller means to a support means, the male member including a roller integral with the other end of the shank and the female member being integrally part of said support means.

6. The invention of claim 1, 2 or 3 wherein the groove is tapered inwardly with an included angle of 10°.

7. The invention of claim 1 wherein the slope of the two frustoconical shank portions is the same.

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8. A fastener system as set forth in claim 7, wherein:
said slope of said two frustoconical portions of said
shank is approximately 30°.



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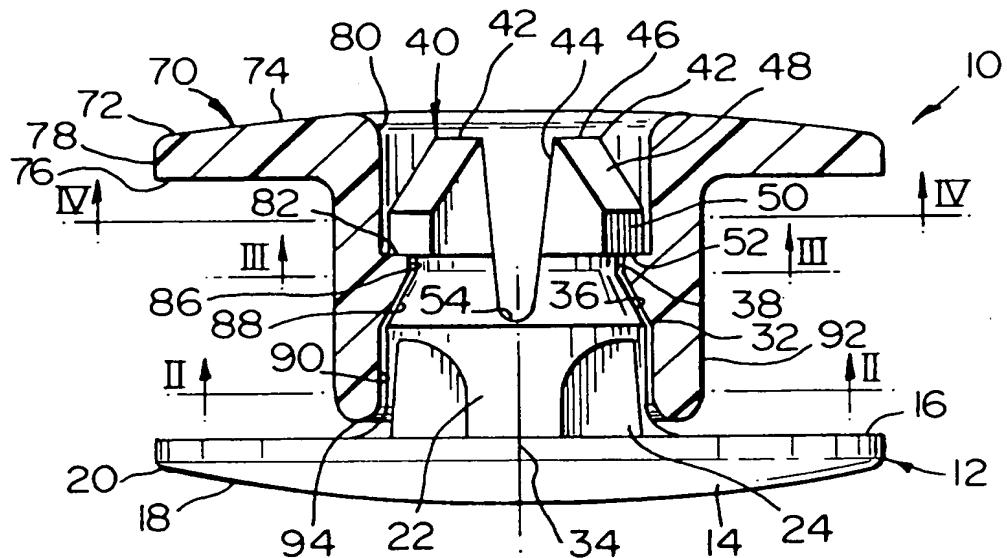


FIG. 1

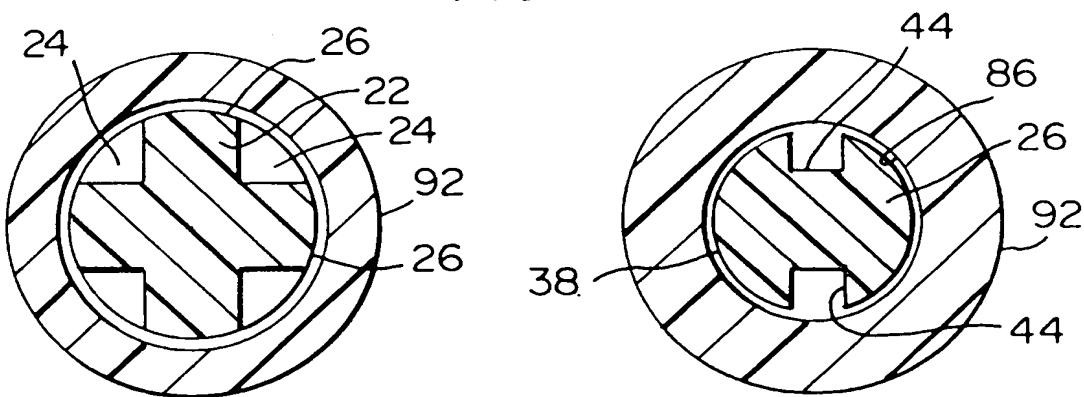


FIG. 2

FIG. 3

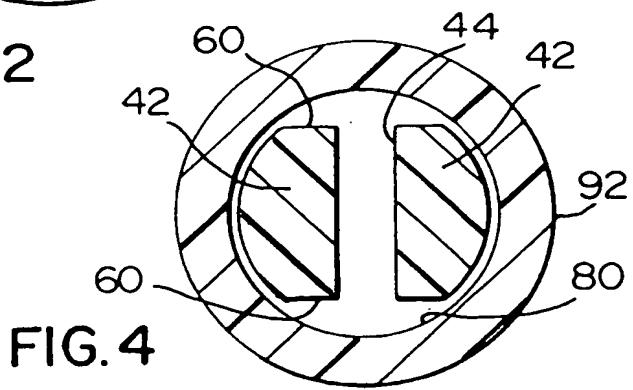


FIG. 4

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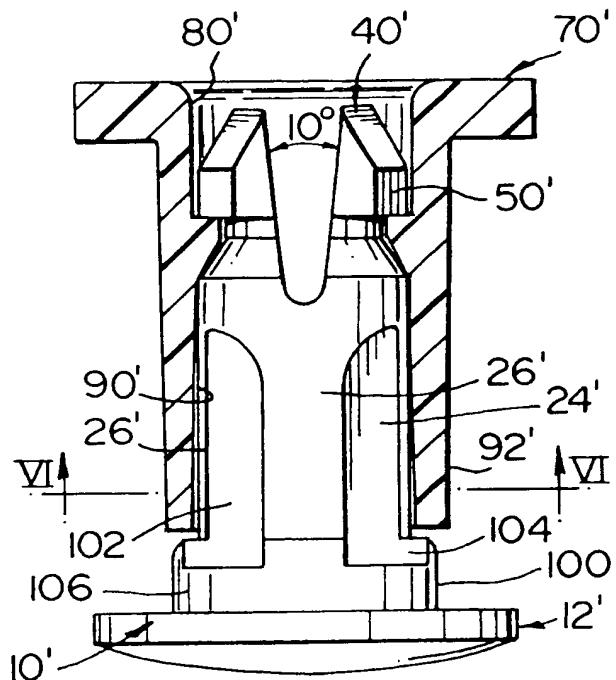


FIG. 5

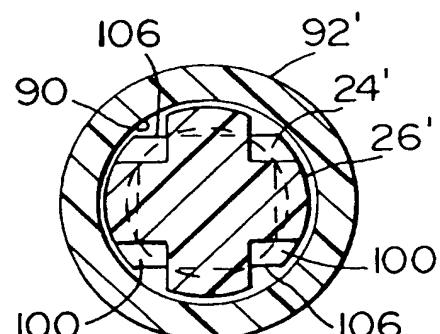


FIG. 6

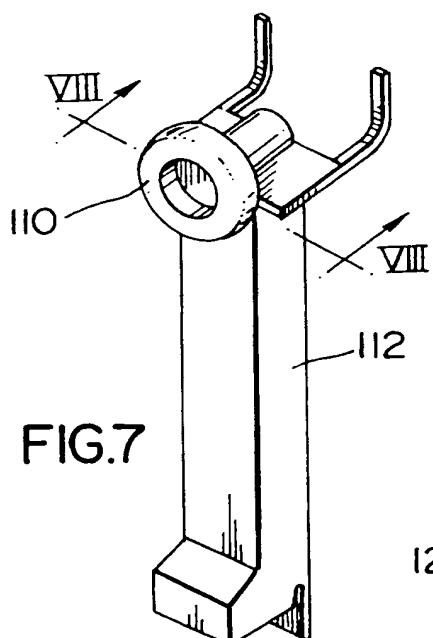


FIG. 7

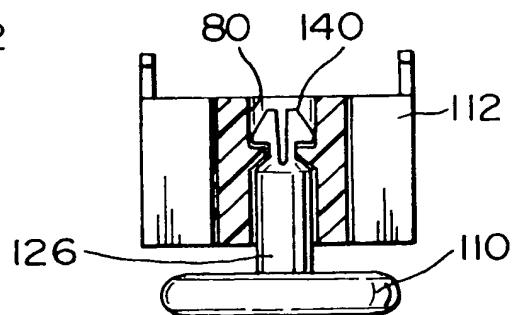


FIG. 8

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